

RENAL GLYCOSURIA.

BY JOHN R. MURLIN, PH.D.,

AND

WALTER L. NILES, M.D.,

(From the Physiological Laboratory of the Cornell University Medical College and the Second Medical Division of Bellevue Hospital, New York City.)

DURING the past summer the writers were engaged in a study of the influence of alkali, administered by duodenal tube, upon the glycosuria and hyperglycemia of human diabetes.¹ Among the cases which presented themselves was the following:

CASE HISTORY.—Frank B., a poorly nourished young man, aged twenty years, was admitted to Bellevue Hospital on June 28, 1916. His family history was negative for tuberculosis and diabetes. He had had measles only as a child, and had always been strong and well up to the present illness, which began in November, 1914, with pains in his abdomen and epigastrium after meals. He also had furuncles, polyuria, and thirst, and became very weak in spite of a good appetite. He lost ten pounds in one month. He was then told by physicians that he had diabetes, and went to a hospital, where he was dieted, leaving the hospital sugar-free. Since that time he had been eating very little starch and no sugar. His urine was examined in October, 1915, and sugar was present. Since June 1, 1916, he had lost more weight and felt extremely tired. Upon admission to the hospital his thirst was not excessive, and he had no polyuria or infections.

His physical examination was negative, except that his tongue was slightly reddened and his breath gave a faint odor of acetone. The reflexes were a little sluggish.

On July 2 the patient was placed on a restricted diet containing 50 grams of carbohydrate, with a total food intake of about 35 calories per kilo. On the second day of this diet he excreted 24 grams of glucose. When the diet was changed (see table) so as to contain 15 grams of carbohydrate, he continued to excrete the same amount of sugar. By this time we had already suspected the nature of the glycosuria. Examination of the blood-sugar at 11 A.M., five hours after breakfast, revealed a normal percentage on several days. The diet was continued, with but slight variations, for eight days, and throughout this period the amount of sugar excreted did not vary more than 2 grams from a mean of about 26 grams daily, which was 11 grams more than the food contained. He was evidently also in minus nitrogen balance, for the urine alone contained some 4 to 6 grams more of nitrogen than did the food. Of this amount

¹ Murlin and Craver: Jour. Biol. Chem., December, 1916, vol. xxvii.

5 per cent. was ammonia nitrogen. The degree of acidosis, therefore, was mild.

When the carbohydrate in the food was increased to 100 grams, mainly by the addition of oatmeal, the excretion rose on the first day 10 grams, the next day 6 grams more, and then it returned in two days to about its former level. During the last four days of this period it fell 3 or 4 grams below this level. The blood taken at the same time of day continued to show a normal percentage.

CASE I.—FRANK B.

Date.	Weight, kilos.	Food.				Urine.						Blood sugar, per cent. by weight.
		Total calories.	Carbohydrate, grams.	Fat, grams.	Food nitrogen, grams.	Volume, c.c.	Specific gravity.	Acidity, N/100.	NH ₄ -N.	Total nitrogen, grams.	Glucose, grams.	
July												
2-3	58.2	1847	50.5	139.9	13.6	1106	1032	510	0.60	15.49		
3-4	57.7	1896	50.5	142.1	15.2	1360	1028	602	0.66	18.91	23.8	
4-5	57.2	1903	14.9	147.5	19.2	2094	1023	785	0.86	22.98	24.2	
5-6	56.9	1895	14.9	158.8	20.8	1895	1027	853	1.03	24.91	27.1	0.097
6-7	56.7	2020	14.9	156.7	20.4	1705	1028	904	1.28	26.66	28.1	
7-8	56.4	2046	14.9	158.2	20.4	1745	1025	873	1.43	26.90	25.8	0.105
8-9	56.3	2064	14.9	159.2	20.8	1337	1032	769	..	25.4	27.9	
9-10	56.8	2064	14.9	159.2	20.8	1770	1024	717	..	24.5	26.0	0.102
10-11	56.5	2222	14.9	171.3	22.6	1845	1023	756	..	24.5	25.7	
11-12	55.8	2224	14.9	171.0	22.3	1330	1029	745	..	24.1	24.0	
12-13	56.2	2592	100.4	170.7	23.5	1620	1027	753	..	24.1	34.1	
13-14	55.8	2262	100.4	153.5	16.8	1024	1036	655	..	16.9	39.8	0.091
14-15	56.5	2262	100.4	153.5	17.4	1535	1026	629	..	14.7	35.0	
15-16	56.2	2262	100.4	153.5	16.8	1850	1022	620	..	17.6	30.6	0.081
16-17	56.1	2245	100.4	153.1	16.4	1815	1020	560	..	17.2	25.0	
17-18	55.9	2262	100.4	153.5	16.8	2125	1016	537	..	15.8	19.2	0.085
18-19	56.1	2254	100.4	153.7	16.4	1565	1023	614	..	16.6	22.3	
19-20	56.2	2261	100.4	153.7	17.4	1710	1022	654	..	16.7	24.4	0.092
20-21	56.1	2261	100.4	153.7	16.5	1280	1028	589	..	16.1	22.6	0.08
27-28	..	..	General ward diet				1850	..	..	..	34.4	
Aug.												
23-24	..	..	Practically unrestricted diet				1200	1033	726	..	19.6	30.9
24-25	..	..	Fasting. .. ..				..	..	..	..	0.0	

The characteristics of renal glycosuria have been succinctly stated by Allen² as "glycosuria, with normal glycemia, relatively independent of diet." It is evident that the case described fulfils this definition precisely. In its chemical aspects it very closely resembles the case recently described by Lewis and Mosenthal.³ With from 14 to 270 grams of carbohydrate in the diet the excretion of sugar in their case varied between 4.3 and 27 grams, the blood-sugar being normal.

There is one difference, however, which may be worthy of note, though we are not certain that it has any significance for this type of malady—namely, whereas it required six days of starvation to clear away sugar from the urine in their case, in ours it required only one day. At this time the young man had been living in the

² Glycosuria and Diabetes, Boston, 1913, p. 544.

³ Bull. Johns Hopkins Hosp., 1916, xxvii, 133.

country and working as a gardener for one of the writers for about a month following the termination of the observations made in the hospital. He had improved markedly in strength, beginning with light work and increasing until he was able at the time mentioned to mow a rather large lawn without undue fatigue. On a diet containing oatmeal for breakfast, one slice of bread at each meal, and two glasses of milk, besides green vegetables and plenty of meat, his urine contained only 30.9 grams of glucose. This was the day before fasting. The fasting urine, begun at 7 A.M., twelve hours after his last meal, contained only the faintest possible trace of glucose, not more than is often found in normal urines.

The patient returned to the city October 1, 1916, and found work as a street-car conductor. His urine at this time contained a considerable amount of sugar, which was not quantitatively estimated.

CLINICAL STUDIES OF ACIDOSIS.

BY J. HAROLD AUSTIN, M.D.,

AND

LEON JONAS, M.D.,

WOODWARD FELLOW IN PHYSIOLOGICAL CHEMISTRY, UNIVERSITY OF PENNSYLVANIA,
PHILADELPHIA.

(From the William Pepper Laboratory of Clinical Medicine, University of
Pennsylvania.)

DURING the past few years much progress has been made in the study of the regulation of the body fluids as regards acidity and alkalinity and in the development of our conception of the condition known as acidosis.

Acidosis may well be compared with disturbance of the body temperature. It is recognized that life can continue only within a limited range of temperature variation and that health is compatible only with a still more restricted range. We are, more or less, familiar with the mechanisms which regulate the body temperature and maintain its constancy. Similarly, we have learned that the reaction of the body fluids as regards acidity and alkalinity must possess a degree of constancy even greater than must their temperature, if a normal condition or, indeed, life itself is to continue. Largely through the work of Lawrence Henderson,¹ and

¹ Clinical Studies on Acid Base Equilibrium and the Nature of Acidosis, *Arch. Int. Med.*, 1913, xii, 153. Sellards, A. W., the Determination of Equilibrium in the Human Body between Acids and Bases, with Especial References to Acidosis and Nephropathies, *Bull. Johns Hopkins Hosp.*, 1912, xxiii, 289.